

**USER ACCESS TO A REGISTRY OF BUSINESS ENTITY DEFINITIONS****Field of the Invention**

5           The present invention relates to user access to a registry, such as a UDDI registry, of business services and more specifically to the user obtaining details of a business service from the registry.

**Background to the Invention**

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Over recent years it has become commonplace for a business to provide the ability for a user to purchase goods from the business using a computer which communicates with a computer of the business. For example a business may provide a web site on the Internet which enables a user to purchase goods from the business over the world wide web. Following on from this success it has become a requirement to more easily locate suitable businesses to deal with and this requirement has been satisfied by the arrival of registry services, such as specified by UDDI (Universal Description, Discovery and Integration), which provide support for business entities which provide services.

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A UDDI registry enables a business entity to publish information about the services it provides and a user to discover information about published business services. Accordingly, for example, a user can send a request to the UDDI registry to obtain details of business services which provide a particular service which the user requires. The user then chooses from one or more business services for which details are returned by the UDDI registry and the sends an appropriate request to the chosen business service. However the UDDI registry may return to a user details of a business service which it does not have appropriate permission to access and, as a result, the user will not discover that they cannot access a particular business service until their request to the particular business service is rejected.

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This is a waste of time and resource for the user in making a request to a business service which is bound to fail, and a waste of time and resource for the business which provides the service which must handle requests from users which do not have the required permissions to access it. As a result it would be advantageous to provide a method of saving such waste time and resource.

Summary of the invention

5 The present invention addresses this problem by providing means for a registry which hold business entity definitions, such as a UDDI registry, to restrict user access to information in the business definitions to that which the user has permission to access.

10 According to a first aspect the present invention provides a method for a registry of business entity definitions to handle users requests to access business entity definitions, the method comprising steps of: receiving a request from a user to access a business entity definition; obtaining, from data associated with the request, the identity of the user; determining, from permission details associated with the business entity definition and the identity of the user, whether the user has  
15 permission to access information in the business entity definition; and denying the user access to information in the business entity definition if it is determined that the user does not have permission.

20 According to a second aspect the present invention provides a registry of business entity definitions for handling requests to access business entity definitions, the registry comprising: means for receiving a request from a user to access a business entity definition; means for obtaining, from data associated with the request, the identity of the user; means for determining, from permission details associated with the business entity definition and the identity of the user, whether the user  
25 has permission to access information in the business entity definition; and means for denying the user access to information in the business entity definition if it is determined that the user does not have permission.

30 According to a fourth aspect the present invention provides a registry service for handling a user requests to access business entity definitions, providing the service comprising the steps of: receiving a request from a user to access a business entity definition; obtaining,  
35 from data associated with the request, the identity of the user; determining, from permission details associated with the business entity definition and the identity of the user, whether the user has permission to access information in the business entity definition; and denying the user access to information in the business entity definition if it is  
40 determined that the user does not have permission.

According to a third aspect the present invention provides and computer program product comprising instructions which, when run on a data processing host, cause said data processing host to carry out a method according to the first aspect.

5       The user access request could be to read, update or delete all or a subset of the information contained in a business entity definition. If the request is to read the business service definition it could be a request to read a specific business entity definition or a business entity definition which satisfies search criteria specified in the request. For  
10       example the search criteria could be used locate the business entity definition and determine what information in the business entity definition the user wishes to access.

15       Optionally the business entity definition may comprise a plurality of information elements and permission details are associated with each of these information elements. As a result the permission details can be used to only deny a user access to those information elements for which the permission details indicate they do not have the required permission. However note that this does not require all information elements in a  
20       business entity definition to have associated permission details. Further note that it is not necessary to determine if a user has permission to access all information elements which have associated permission details but only those information elements which the user has requested to access.

25       If permission details are associated with a plurality of information elements in a business entity definition an access policy can be used which is used to determine whether a user has permission to access an information element using both the permission details associated with the information element and the permission details of a different information  
30       element. For example, if the information elements are in a hierarchy such that a first information element contains one or more second information elements access to the first information element can be denied if the user does not have access to all, or a subset, of the second information elements contained within it.

35       Permission details could comprise, for example, identifiers for one or more clients or users, and/or identifiers for one or more client or user groups which have access to the business entity definition, or information elements of the business service definition, with which they  
40       are associated. Further the levels of access an identifier has can also be indicated, for example read, update and delete. Further permission details could be stored in a variety of formats, for example in an Access Control

List (ACL) which is a file containing a list of users and access rights for each user.

5 Preferably permission details are obtained from a file system in which their association with a business entity definition, or information element in the business entity definition, is used to determine their location in the file system. For example, if a unique key is associated with a business entity definition and each information element contained within it, the ACL associated with an information element will be the in a  
10 directory defined by the key of a business entity definition and the key of the information element. As a result the permission details can be easily located and the business entity definition does not require updating to contain or refer to permission details. Alternatively permission details could be included in, or referenced from, the business  
15 entity definition, or information element in the business entity definition, with which they are associated.

20 Optionally the registry is a UDDI registry and the information in the business entity definition is a businessEntity information element, the businessEntity information element containing one or more businessService information elements, each businessService containing one or more binding template information elements and each binding template containing one or more references each referring to a technical model  
25 information element.

30 Optionally the user could be a web user who communicates with the UDDI registry over the internet to obtain details of web services which can be accessed over the internet.

#### Brief Description of the Drawings

35 The invention will now be described, by way of example only, with reference to a preferred embodiment thereof, as illustrated in the accompanying drawings, in which:

40 Figure 1 is a block diagram of a data processing environment in which the preferred embodiment of the present invention can be advantageously applied;

Figure 2 is a schematic diagram of the main information elements in a business entity definition according to the prior art UDDI specification;

Figure 3 is a schematic diagram which shows an example of a user attempting to access a business service for which they do not have the required permission to access, according to the prior art UDDI specification;

Figure 4 is a schematic diagram of a business entity definition and associated access control lists, according to the preferred embodiment of the present invention;

Figure 5 is a schematic diagram which shows an example of a user attempting access a business service which they do not have permission to access, according to the preferred embodiment of the present invention; and

Figure 6 is a flow chart of an overview of the method followed by a UDDI registry and Access Manager according to the preferred embodiment of present invention.

#### Description of the Preferred Embodiment

In figure 1, a client/server data processing host 10 is connected to other client/server data processing host 12 and 13 via a network 11, which could be, for example, the Internet. In the preferred embodiment a UDDI registry may be installed on any such client/server and accept requests to define/update details of a web service, or obtain details of a web service, from a user using the same or another client/server data processing host. Client/server 10 has a processor 101 for executing programs that control the operation of the client/server 10, a RAM volatile memory element 102, a non-volatile memory 103, and a network connector 104 for use in interfacing with the network 11 for communication with the other client/servers 12 and 13.

The preferred embodiment is discussed in terms of a business entity definition and a UDDI registry according to the UDDI specification. The UDDI specification defines a set of XML schemas which are templates for creating definitions of business entities. As a result a business entity definition may be an instance of one or more these defined XML schemas.

Figure 2 is a schematic diagram of the main components of an example business entity definition according to the prior art UDDI specification. The business entity definition provides details of services provided to the UDDI registry by a business. The business entity definition comprises

a businessEntity 201 which includes descriptive information 202 about the business and information about one or more business services which the business entity offers. The descriptive information 202 includes a name and description of the business, one or more identifiers, and one or more categories. The identifiers are used to uniquely identify the business, and the one or more categories are used to identify, for example, the industry type, product type, and geographic location of the business. The information about services which the business offers is in one or more businessService entities 203.

Each businessService entity 203 further provides descriptive and technical information about the service. The descriptive information 204 includes a name and description of the service and one or more categories which apply to service. The technical information comprises one or more binding templates 205 each of which includes a binding description, one or more categories which apply to the binding, one or more references each referring to a technical model (tModel) 207, and an accessPoint which defines an endpoint address at which the service can be contacted. In UDDI a tModel can be used for a variety of purposes although the main purpose is to provide information which enables a user to make requests to the service defined by the businessService entity which contains it. Accordingly a tModel may include such information as the interfaces and communication protocol which a service supports, although such information may be provided using more than one tModel. Thus, if a service provides more than one binding template it will support more than one method of communicating with it.

Note that figure 2 only illustrates a subset of the information which can be defined in an business entity definition, for example the businessEntity descriptive information 202 may include contact details. Further figure 2 does not describe the complexities associated with some information parts, for example categories. However, such additional information is not relevant to the present invention.

For example an business entity definition which describes a group of web services may comprise a businessEntity which specifies: a name of "Abank"; a description of "Abank is a web based bank providing financial services"; categories of "finance" and "UK"; an identifier which includes "plc" and Abank's company registration number; and 3 businessService entities which describe services of accounts, shares, and pensions which the business entity provides. For example the businessService entity which describes the shares service might specify: a name of "shares"; a

description of "Abank's share service"; categories of "shares" and "UK"; and two binding templates which define two different methods of accessing the share service, one for buying shares and the other for selling shares. For example the binding template describing the buying shares service might specify: a description of "Abank's share purchase service"; categories of "purchase" and "London Stock Exchange"; an accessPoint specifying a URL at which the share service can be located; and references to two tModels, one for users which wish to access the service using Simple Object Access Protocol over Hypertext Transfer Protocol (SOAP/HTTP) and the other using Internet Inter-Orb Protocol (IIOP). For example the tModel describing how to access the share buying service using SOAP/HTTP will include: information specifying SOAP/HTTP and a specification of purchaseEnquiry, purchaseConfirm and purchaseDecline requests. Note that the values specified in this example for categories would be from a predefined and well known taxonomy with which the user would be familiar.

Figure 3 is a schematic diagram which shows an example of a user attempting access a service which it does not have permission to access, according to the prior art UDDI specification. The user, using machine ClientX 301, first sends a request (311) to the UDDI Registry 302 which specifies that they wish to obtain details of share buying services available in the UK. The UDDI registry then searches its database 303 of business entity definitions 304 which have been registered with it. It finds several which include the one described above for Abank 305, and returns (312) details of them to Client X 301 for the user. The user prefers to use Abank and elects to communicate using SOAP/HTTP and as a result ClientX 301 sends a purchaseEnquiry request (313), using SOAP/HTTP, specifying the userId of the user, for example "Alex" to Abank 305. However, Abank requires users to complete an off-line registration procedure before accessing its share service and "Alex" has not previously completed this procedure. As a result Abank 305 refuses (314) to handle the purchaseEnquiry request received from "Alex" who then receives an error response to the request. The user must now select a different share service, of a different business entity, to use from those previously returned (312) by the UDDI registry 302. Note that the request (311) sent by the user to UDDI registry 302 could also be to obtain details specifically for Abank.

According to the present invention, in the example of figure 3, the user of ClientX 301 has used unnecessary time and resources selecting the Abank service 305 and sending a purchaseEnquiry request (313) to it.

Further the Abank service 305 has used unnecessary time and resources handling and rejecting the request from the unauthorised user. As a result it would be better if the user was not returned details of a web service, such as provided by Abank, which it is not authorised to access.

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According to the preferred embodiment of the present invention an external Access Manager is configured into a UDDI Registry so that an Access Control List (ACL) can be defined for one or more information elements ( e.g.: businessEntity, businessService Entity etc.) in a business entity definition held in the registry. The ACL is then used to control which users are permitted to see/read, update and/or delete the entity. Note that for update and delete, the ACL overrides the standard UDDI behaviour which is that only the user that created the entity can update it or delete it. Further note that the ACL can, for example, include identifiers which specify a particular user and/or identifiers which specify a group of users, and further include details for each user or group of users which operation the user is allowed to perform, such as read, update and/or delete.

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Figure 4 is a schematic diagram of an example business entity definition according to the preferred embodiment of the present invention. The diagram has common parts with figure 2 and for which like numbers are used. However the diagram further includes Access Control Lists 401, 402, 403 and 404. An ACL 401 is associated to the businessEntity 201 and contains a list of users who can access the BusinessEntity and descriptive information 202 contained within in it. The businessEntity includes several businessService entities 203 each of which is also associated with an ACL 402. A businessService entity requires an ACL 402 if only a subset of the users who can access the business entity definition can access the BusinessService entity and therefore an ACL 402 contains a subset of users listed in ACL 401. Within each businessService entity are several binding templates each of which are associated with an ACL 403. A binding template requires an ACL 403 if only a subset of the users who can access the businessService entity can also access the binding template. Within each binding template is a reference to one or more tModels each of which are also associated with an ACL 404. Note that tModels are referenced from, and not included in, a binding template and as a result the same tModel can be referenced from more than one binding template and from different business entity definitions. This means that ACL 404 does not necessarily contain a subset of the users defined in ACL 403 but instead a more general list which can apply to all the business entity definition locations from which it is referenced.

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For example, a business entity definition which describes an Xbank business entity which provides account, shares and pensions web services defined in business service entities may have associated ACLs as now described. The bank permits all users from the UK to access its services so the ACL associated with the businessEntity specifies a group which defines UK users. However the share service is limited to registered users of which there are 4 : DealerTrusted, Dealer, PricerTrusted and Pricer. As a result the ACL associated with the businessService entity which defines the share service lists only these four users. The businessService entity which defines the share service includes two binding templates one for obtaining prices of shares and one for both obtaining prices and dealing in shares. DealerTrusted and Dealer are dealers and as a result the ACL associated with the binding template for obtaining prices and dealing in shares lists only these two users. PricerTrusted and Pricer only make price enquiries and as a result the ACL associated with the binding template for obtaining share quotes contains only these two users. The binding template for obtaining prices and dealing in shares contains references to four tModels: tMDealSecure, tMDeal, tMPriceSecure and tMPrice. tMDealSecure and tMDeal describe how to access the dealing function, tMDealSecure using a secured connection and tMDeal using a non-secured connection. tMPriceSecure and tMPrice describe how to access the obtaining prices function, tMPriceSecure using a secured connection and tMPrice using a non-secured connection. The binding template for obtaining prices contains references to two tModels which are tMPriceSecure and tMPrice. Associated with each tModel is an ACL. The ACL for tMDealSecure only lists Dealer who is a not a trusted dealer and so must use a secured connection. The ACL for tMDeal only lists DealerTrusted who is a secure dealer and trusted to access the service using a non-secured connection. The ACL for tMPriceSecure lists Dealer and Pricer because neither are trusted and so must use a secured connection. Finally the ACL for tMPrice lists DealerSecure and PricerSecure because both are secure and trusted to access the service using a non-secured connection.

Note that in another embodiment one or more of the information elements (businessEntity, businessService, binding template, tModel) in the hierarchy may not have an associated ACL. In this case, it can be assumed that all users who can access an information element can also access any information element contained within it which does not have an associated ACL. For example if a binding template does not have an associated ACL it is assumed that all users who can access the businessService which contains it can also access the binding template.

In the preferred embodiment the ACLs are associated with the business entity definitions using a virtual file system. For example, in UDDI each information element can be associated with a unique key such that each businessEntity, businessService, binding template and tModel has a unique key. These keys may therefore be used to access an ACL from a directory structure which follows the same hierarchy as the business entity definition. As a result, for example, if the key for the Xbank business entity is "Xbank", the key for a Xbank share businessService entity is "shares", and the key for the share service binding templates are "dealers" and "pricers" the ACLs are placed in a directory structure as follows:

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/uddi/Xbank/<ACL for Xbank businessEntity>
/uddi/Xbank/shares/<ACL for share businessService>
/uddi/Xbank/shares/dealers/<ACL for dealers binding template>
/uddi/Xbank/shares/pricers/<ACL for pricers binding template>
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However, note that for illustrative purposes the keys used in this example are somewhat simplistic and are unlikely to be unique with other business entities. In practice, in order to obtain uniqueness, a key is likely to be more complicated and comprise a UUID (Universal Unique Identifier).

In another embodiment the business entity definition could be updated to include an appropriate ACL or a reference to an appropriate ACL.

Figure 5 is a schematic diagram which shows, according to the preferred embodiment of the present invention, an example of a user attempting access a business service which they do not have the required permission to access. The diagram has common parts with Figure 3 and for which like numbers are used. The user, using machine ClientX 301, first sends a request (511) to the UDDI Registry 302 which specifies that they wish to obtain details of share buying services available in the UK. The user request (511) further includes an identifier for the user, for example "Fred", which is added to a context associated with the flow, for example by middleware running in ClientX 301. The UDDI registry then searches its database 303 of business entity definitions 304, which have been registered with it, for those which provide the service requested. It finds and retains a list of several suitable business entities one of which is Xbank 502. Configured with the UDDI registry is an Access Manager 501 which the UDDI registry then requests to check each ACL 504 which is

associated with any of the relevant information elements in the business entity definitions which it has located. The check uses the user identifier included in the context with the user request (511). For example, with reference to the example above, the Xbank business entity permits access to all users in the UK of which "Fred" is one. However the Xbank share service is not accessible to "Fred" because it only permits access to 4 users, namely: DealerTrusted, Dealer, PricerTrusted and Pricer. As a result the Access Manager (501) indicates to the UDDI registry that an authentication has failed and as a result details of Xbank are removed from the list of services returned by the registry. Once the UDDI registry has used the Access Manager to check all business entities in the list it returns (512) to ClientX 301 only those which it has permission to access.

Note that in the example of figure 5 the user request is to obtain a list of business entities which satisfy a search criteria. In another embodiment the request could be for details of a specific business entity or to update or delete the XML schema of the business entity.

Further note that it is the responsibility of the business provider to provide to the UDDI registry suitable permission lists, such as ACLs, for its business entity definition(s). As a result, because the UDDI registry and business are likely to be in different security domains and therefore do not have access to the same permission list, the ones available to the UDDI registry may become out of date. As a result it is possible that a user will not be provided with details of service to which he has access or he may be provided with details of a service to which he does not have access.

Figure 6 is a flow diagram of the main method steps followed by a UDDI registry and access manager according to the preferred embodiment of the present invention. At step 601 a request is received from a user to access a business entity definition. The type of access specified by the request could be to update, delete or read the business entity definition. At step 602 the business entity definition for which access was requested is located and at step 603 an identifier of the user is obtained from information sent, at step 601, with the request. The identifier could be for a particular user or a group of users, and this along with details of the one or more business entity definitions and the type of access sought, are then provided to the Access Manager. At step 604 the access manager locates permission details associated with the business entity definition, for example by locating them in a virtual file system known to the access

manager, and then, at step 605 checks to see if the identified user has, according to the permission details, the required permission to access the business entity definition or one or more information elements contained within it . If the user does not have the required permission the user request is rejected and an error returned at step 606. However if the user does have the required permission the request is permitted access the business entity definition at step 607. It is also possible that the user has limited access to the business entity definition and, if so, step 607 only permits access to the subset of the business entity definition to which the user has access.

Note the flow diagram of Fig. 6 is simplified and the steps do not necessarily have to be carried out in the order specified. For example, given a business entity definition which has a plurality of associated permission details, each for a different information element in the business entity definition, steps 604 and 605 could be carried out in a loop such that permission details are obtained and then checked for each information element in turn. Further if the request is a read request it may specify a search criteria for which the UDDI registry locates one or more business entity definitions which satisfy the criteria. In this case the steps 604, 605, 606 and 607 may be in a loop which check each of the one or more business entity definitions in turn.

Note that a skilled person in the art would realise that the method described with reference to figure 6 could be implemented in a variety of programming languages, for example, Java™, C, and C++ (Java is a registered trademark of Sun Microsystems, Inc. in the United States, other countries, or both.). Further a skilled person would realise that once implemented the methods can be stored in a computer program product comprising or more programs, in source or executable form, on a media, such as floppy disk, CD, and DVD, suitable for loading onto a data processing host and causing the data processing host to carry out the methods.

Further note that whilst the invention has been described in terms of a UDDI registry a skilled person would realise that a registry could be implemented, which is not a UDDI registry, but provides a similar function to a UDDI registry.

Thus, according to the present invention a registry, such as a UDDI registry, restricts access to business entity definitions contained in the registry according to permission details associated with the business

5 service definition. A business entity definition may comprise a plurality of information elements. Permission details, which define users or groups of users with permission to access the information element, are then associated with one or more of these information elements. When a user request is received to access a business entity definition access is restricted to only those information elements for which the user has the required permission.